Unit 6 PACKET Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**6-1 Balancing Reactions**

**Notes**

**Vocab**

**Reactants** – The things that react together (on the left side of the equation)

**Products** – The things that are produced (on the right side of the equation)

**Yields** – The arrow in the middle of the equation.

**Coefficients** – The big numbers in front

**Balanced** – The amount of atoms on the left of the yield sign are the same as the amount of atoms on the right. This is to satisfy the Law of Conservation of Mass (mass can’t be created or destroyed)

**Exothermic** – Releases heat (feels hot)

**Endothermic** – Absorbs Heat (feels cold)

**Precipitate** – Solid produced by a double replacement reaction that falls out of the solution.

Symbols (written as subscripts)

|  |  |
| --- | --- |
| (s) | Solid |
| (l) | Liquid |
| (g) | Gas |
| (aq) | Dissolved in water (aqueous) |

**Process**: change the coefficients to balance the equation. Go left to right. Check again.

**Fe(s) + Cl2(g) → FeCl3(s)**

**Step 1: Add more Cl2**

**Fe(s) + 2Cl2(g) → FeCl3(s)**

**Step 2: Add more FeCl3**

**Fe(s) + 2Cl2(g) → 2FeCl3(s)**

**Step 3: Add more Fe and Cl2**

**2Fe(s) + 3Cl2(g) → 2FeCl3(s)**

**Counting Atoms**

* 5O2 = 10 Oxygen
* NH4 = 1 Nitrogen, 4 Hydrogen
* 2NH4 = 2 Nitrogen, 8 Hydrogen
* 3(MnO4)2 = 6 Manganese, 24 Oxygen

**Tricks**

-If you have an element in multiple places do it last

-Flipping the Subscripts

* + O5 🡪 O2 Use the subscripts as the 2O5 🡪 5O2  opposite one’s coefficient

-Chunking Polyatomic Ions

* Hg(MnO4)2 + Al2(Cr2O7)3 🡪 HgCr2O7 + Al(MnO4)3

Notice that there are the same polyatomic ions on both sides. Instead of breaking them up, balance them together.

* 3Hg(MnO4)2 + Al2(Cr2O7)3 🡪 HgCr2O7 + 2Al(MnO4)3

Balanced MnO4 by flipping the subscripts

* 3Hg(MnO4)2 + Al2(Cr2O7)3 🡪 3HgCr2O7 + 2Al(MnO4)3

Changing the number at the beginning increases the number of mercury, so by adding a 3 to the Mercury from the other side balances the whole thing.

-Even Odd Double

* C4H8S + O2 🡪 4CO2 + 4H2O + SO3

If you end up with an odd number of something on one side and an even number on the other… double everything then start counting from where you were.

* 2C4H8S + 15O2 🡪 8CO2 + 8H2O + 2SO3

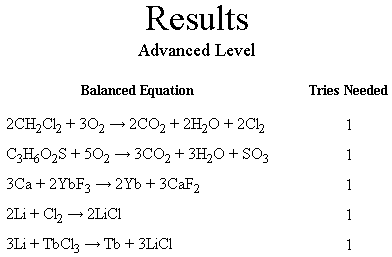
**Reaction Types & Examples**

|  |  |  |
| --- | --- | --- |
| **Reaction Formula** | **Balanced Equation** | **type of Reaction** |
| O2 on the left, CO2 & H2O on the right. | C10H8 + 12 O2→ 10 CO2 + 4 H2O | **Combustion** (because it has oxygen on the left, CO2, andH2O on the right |
| X + Y 🡪 XY | 8 Fe + S8 → 8 FeS | **Synthesis** (because it puts many things into one) |
| XY 🡪 X + Y | 2 H2O → 2 H2 + O2 | **Decomposition** (because it is one thing breaking down into many) |
| AX + B 🡪 A + BX | Mg + 2 H2O → Mg(OH)2 + H2 | **Single** **Replacement** (One of the reactants looses stuff to the other) |
| AX + BY 🡪 AY + BX | Pb(NO3)2 + 2 KI → PbI2 + 2 KNO3 | **Double** **Replacement** (both reactants switch stuff with each other)  Forms a **precipitate** if one of the reactants is solid |
| HX + YOH 🡪 XY + H2O | NaOH(aq) + HCl(aq) 🡪 NaCl(aq) + H2O(l) | **Acid**-**Base** **Reaction** |

**6-1 Worksheet**

* Go to bairweb.wikispaces.com/13-2 & click the link
* Do 5 advanced problems at a time.
* Open a word doc & the snipping tool. Take a screenshot of each completed 5 problems, and paste it in the word doc. Using the notes above, identify what type of reaction each one is that you can. (note: some do not fit the patters above. It is ok to skip those, but be sure.)
* Title the word doc 6-1 Class Period - Last name First name. For example 6-1 2 – Bair Jason.
* Save it on your student account. At the end of 2 days, copy it to my drop off folder.

Example:



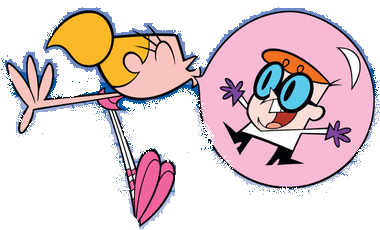
1. Combustion
2. Combustion
3. Single Replacement
4. Synthesis
5. Single Replacement

**6-2 Lab**

**Bubbles of Fire!**

Methane (CH4) is the natural gas used in the school laboratory and in homes. You can create bubbles of methane in tub of soapy water using the gas jet and rubber tubing. Methane will react with oxygen in the air and produce carbon dioxide and water. Write and balance the chemical reaction for bubbles of fire!

\_\_\_\_\_\_ + \_\_\_\_\_\_ 🡪 \_\_\_\_\_\_ + \_\_\_\_\_\_

****

**What type of reaction are bubbles of fire? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Gummy Bear Explosion!**

**1. Put approximately 1 cm of KClO3 in the bottom of a test tube.**

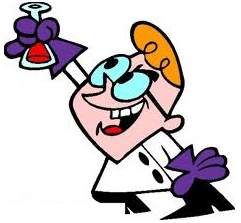
**2. Place the test tube into a clamp pointing away from the hood opening.**

**3. Place the Bunsen burner underneath to decompose the compound.**

**2KClO3 (s) 🡪 2KCl (s) + 3O2 (g)**

**What type of reaction is this? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**3. Remove the Bunsen burner and turn it off. Quickly using a scoopula place the gummy bear into the test tube and step away. Close the hood and observe.**

 **3C11H22O11 + O2 🡪 CO2 + 33H2O + 32 C (s)**

**What type of reaction is this? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**After the test tube cools…What is the black solid in the bottom of the test tube? \_\_\_\_\_\_\_\_\_\_**

**Combustion of Magnesium**  
  
Get a wire gauze, and set it near a bunsen burner. Light a bunsen burner.   
  
Obtain a piece of magnesium metal about the size of your pinky fingernail from your teacher. Make an observation about the *appearance* of the magnesium.  
  
Hold one end of the magnesium with the **crucible tongs** (ones with no plastic) and place the other end of the magnesium into the flame of the burner until it catches on fire. **Then hold the magnesium over the wire gauze on the laboratory bench while it is burning**. Looking directly at the burning magnesium will cause vision problems.  
  
When the magnesium is finished burning, place all the ash on the wire gauze. Make an observation about the new *appearance* of the magnesium ash.  
  
Throw all the ash into the trash and gently shake off the wire gauze into the trash as well. Return the wire gauze to its drawer.   
Keep the Bunsen burner on, but be careful.

**Double Replacement Reaction Forming PBI2**  
  
Fill a clean, small test tube about ¼ full with NaI (Sodium Iodide). Fill a second, clean, small test tube about ¼ full with Pb(NO3)2 (Lead (II) Nitrate). Make an observation about the *appearance* of each liquid.  
  
Pour the test tube with NaI into the second test tube (the one with the Pb(NO3)2) . Make an observation about the *appearance* of the new liquid and solid.  
  
Thoroughly rinse out each test tube (the yellow solid can go down the drain) and let the test tubes air dry.

**6-3 Word Equations**

You will need to be able to write the formulas from the names of compounds and turn it into an equation. You must be able to successfully name Elements, Ionic Compounds, Covalent Compounds, Binary Acids, Oxyacids, & Diatomic Gasses. Complete the notes below to assist you.

**Elements**

* Simply look up the name from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Example: Copper Metal
  + Cu(s)

**Ionic Compounds**

* Ionic compounds have two parts, (Cation & Anion) so they have two names.
  + For example, NaCl is Sodium Chloride.
* You will need to look up the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the periodic table and Criss-Cross
  + Which element is at the top of the group that could be positive or negative? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + The first group has what charge? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + The last group has what charge? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Remember: the anion (second name) will end in \_\_\_\_\_\_\_\_ if it is a simple non-metal
* If the compound starts with a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ it will have a roman numeral after the Cation (first name)
  + The roman numeral indicates the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the Cation (first name).
* Polyatomic ions are usually negative, but \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the only positive one.
* Polyatomic ions usually end in \_\_\_\_\_\_\_ or \_\_\_\_\_\_\_, but some end in ide.
  + List the polyatomic ions that end in ide. (include their formula and charge) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Covalent Compounds**

* Covalent compounds are composed of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ & \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the right side of the periodic table.
  + For example Carbon Dioxide is covalent.
* The Latin \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ will tell you how many of each element there are.
* They are **1\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 3\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 4\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**5\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 6\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 7\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 8\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**9\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 10\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Binary Acids**

* All are named like Hydro\_\_\_\_\_\_\_\_\_\_\_ic acid
* Example: Hydrochloric Acid
  + HCl
* Cross Hydrogen with the nonmetal from the blank. In this example, it is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Oxyacids**

* Oxyacids are named for the polyatomic ion that is bonded with Hydrogen.
* If the polyatomic ion ended in ate it was changed to \_\_\_\_\_\_\_\_\_\_\_ for its acid name, and if it ended in ite it was changed to \_\_\_\_\_\_\_\_\_\_\_\_\_\_ for its acid name.
* Example: Acetic Acid is a cross of Hydrogen and Acetate
  + HC2H3O2
* Example: Nitrous Acid is a cross of Hydrogen and Nitrite
  + HNO2

**Diatomic Gasses**  
Hydrogen gas = H2(g)  
Nitrogen gas = N2(g)  
Oxygen gas = O2(g)  
Fluorine gas = F2(g)  
Chlorine gas = Cl2(g)  
Bromine liquid = Br2(g)  
Iodine solid = I2(g)

\*Note: Unless otherwise stated, water is in liquid form. H2O(l)

**Instructions:**  
*For each of the following, write the skeleton equation and then balance the equation & Identify what kind of equation it is. Be sure to use all proper symbols like (s), (l), (g), and (aq). Identify if a solid precipitate is produced if it is a double replacement.*

**Hint: Be careful with ionic compounds. Sodium Chloride is a mix of sodium and chlorine. Sodium Chlorate & Sodium Chlorite are a mix of sodium with polyatomic ions.**

**Example:**  
Hydrochloric acid & sodium hydroxide react to form solid sodium chloride & water

* Identify what each compound is, then write its formula & balance it.
* Skeleton equation: HCl(l) + NaOH(l) 🡪 NaCl(s) + H2O(l)
* Balanced equation: HCl(l) + NaOH(l) 🡪 NaCl(s) + H2O(l)
* Type of equation: Acid-Base Reaction

\*Note: The yield arrow is represented by either the word yields or produces or sometimes other words meaning the same thing

\*\*Note: The plus signs, which means you are listing multiple chemicals, are represented by the words “and,” “reacts with,” or other similar words.

\*\*\*burning means combustion reaction.

1. Liquid carbon disulfide reacts with oxygen gas to yield carbon dioxide gas and sulfur dioxide gas.
2. Methane (CH4) gas burns with oxygen gas to yield carbon dioxide gas and water.
3. Solid zinc (II) sulfide reacts with oxygen gas to yield solid zinc (II) oxide and sulfur dioxide gas.
4. Solid phosphorus (P4) reacts with oxygen gas to yield phosphorus(V) oxide gas.
5. Solid potassium chlorate decomposes when heated to yield solid potassium chloride and oxygen gas.
6. Solid sodium nitrate decomposes when heated to yield solid sodium nitrite and oxygen gas.
7. Solid copper(II) nitrate decomposes when heated to yield solid copper(II) oxide, nitrogen dioxide gas, and oxygen gas.
8. Solid phosphorus(III) oxide reacts with oxygen gas to yield phosphorus(V) oxide.
9. Ozone (O3) gas decomposes to yield oxygen gas.
10. Solid iron reacts with water to yield solid iron(III) oxide and hydrogen gas.
11. Zinc metal plus Hydrochloric Acid produces Zinc (II) Chloride and Hydrogen gas
12. Acetic acid and Sodium Bicarbonate (NaHCO3) yields water and Sodium Acetate and Carbon Dioxide Gas.

**6-4 Chem Videos**

# https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcR9ORQ1_yxHKTTLmAo0ju87WZPYX8Sn_cPFEy2pDi6LvAg7TEhi6gFor each video

* List evidence of a chemical reaction
* Write the chemical equation from the word equation
* Balance the equation
* Name type of reaction

# Burning magnesium ribbon

Evidence of chemical reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Word equation: Magnesium solid + oxygen 🡪 magnesium oxide

Balanced Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Type of Reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Mercury thiocyanate

Evidence of chemical reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Word equation: Mercury (II) thiocyanate 🡪 mercury (II) sulfide + carbon disulfide + tricarbon tetranitride

Balanced Equation: \_\_Hg(SCN)2 (s)🡪\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Type of Reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Magnesium and hydrochloric acid with wooden splint

Evidence of chemical reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Word equation: Magnesium solid + hydrochloric acid 🡪 magnesium chloride + hydrogen gas

Balanced Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Type of Reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Lead nitrate and potassium iodide

Evidence of chemical reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Word equation: Lead II nitrate + potassium iodide 🡪 lead II iodide + potassium nitrate

Balanced Equation:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Type of Reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Sodium hydroxide and hydrochloric acid

Evidence of chemical reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Word equation: Sodium hydroxide + hydrochloric acid 🡪 sodium chloride + water

Balanced Equation:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Type of Reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Combustion of ethanol

Evidence of chemical reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Word equation: ethanol + oxygen 🡪 carbon dioxide + water

Balanced Equation: \_\_C2H5OH(l) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Type of Reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**6-5 Solutions**

**6-5 Notes**

* solutions are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This means solutions contain two or more substances, and are mixed enough to “look all the same”. Solutions do NOT have to be liquids, bronze is a solid solution and air is a gaseous solution.
* All solutions have two parts. The substance doing the dissolving is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the substances being dissolved are the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

If you don’t know which is which, the substance you have the most of overall is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* The most common solvent is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**. It is so common and dissolves so many things that it is often called “the universal solvent”.
* Water is a polar molecule because it has a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ shape. Since it is irregularly shaped this means that one side has a slightly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ side and the other is slightly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, so it acts like a little magnet for other polar solutes. Nonpolar substances will not dissolve in water (we say they are insoluble.)
* Like dissolves like – A Polar solute will dissolve in a polar solvent, and non polar solute will dissolve in a non polar solvent.
* Even when things are soluble in water, or any other solvent, different solutes will dissolve to different amount. The actual amount (in grams) that will dissolve in 100 grams of a solvent is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. When discussing the solubility of solutes, solutions are classified into 3 types: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ solution has dissolved as much solute as it can. If you add sugar to iced tea and sugar is just sitting at the bottom of the glass your iced tea is saturated for sugar.
* An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ solution can still dissolve more solute.
* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ solution has been “tricked” into dissolving more solute than it should be able to. If any more solute is added to a supersaturated solution, all the extra solute will undissolve (precipitate). This is how sugar crystal candy (rock candy) is made.
* Solubility curve – if you plot the grams and the temperature and you are above the line, you are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, if you are on the line, you are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and if you are below the line, you are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Temperature is not the only factor that will affect how much solute can dissolve. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ also have an effect
* How to increase solubility for a solid or a gas in a liquid

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| --- | --- | --- |
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|  |  |  |

Concentration – Molarity

* Molarity = moles of solute divided by the liters of solution
* Example 3 moles of HCl in 1 liter would be a 3 molar solution written as 3 M HCl

Electrolytes

* If a solute dissolved in solutions \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (breaks apart into positive and negative parts) these parts will allow electricity to travel through the solution. For example: pure water will not conduct electricity, but if table salt is added, then the sodium and chlorine that break apart will conduct electricity.
* NaCl → Na+ + Cl-
* Solutions that don’t conduct electricity are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.**

**6-5 Molarity Worksheet**

* To solve: fill in what you know and find the unknown. The equation is Molarity = (# of moles/liters of solution)

If you are solving for molarity, you will just divide, but if you are solving for # of moles or liters of solution, you will need to rearrange the equation. Molarity x Liters = # of moles. Liters = # of moles/Molarity. You should be able to do that yourself. I will probably not provide the second two equations for you on the test.

* If you are given or asked to find grams, you will have to convert grams to moles.

# grams = 1 mol/molar mass. # mol = molar mass/1 mol

You should know these. They will probably not be provided for you on the test.

1. Sea water contains roughly 28.0 g of NaCl per liter. What is the molarity of sodium chloride in sea water?

2. What is the molarity of 245.0 g of H2SO4 dissolved in 1.00 L of solution?

3. What is the molarity of 5.30 g of Na2CO3 dissolved in 400.0 mL solution?

4. What is the molarity of 5.00 g of NaOH in 750.0 mL of solution?

5. How many moles of Na2CO3 are there in 10.0 L of 2.0 M soluton?

6. How many moles of Na2CO3 are in 10.0 mL of a 2.0 M solution?

7. How many moles of NaCl are contained in 100.0 mL of a 0.20 M solution?

8. What weight (in grams) of NaCl would be contained in problem 7?

9. What weight (in grams) of H2SO4 would be needed to make 750.0 mL of 2.00 M solution?

10. What volume (in mL) of 18.0 M H2SO4 is needed to contain 2.45 g H2SO4?

11. What volume (in mL) of 12.0 M HCl is needed to contain 3.00 moles of HCl?

12. How many grams of Ca(OH)2 are needed to make 100.0 mL of 0.250 M solution?

13. What is the molarity of a solution made by dissolving 20.0 g of H3PO4 in 50.0 mL of solution?

14. What weight (in grams) of KCl is there in 2.50 liters of 0.50 M KCl solution?

15. What is the molarity of a solution containing 12.0 g of NaOH in 250.0 mL of solution?

16. Determine the molarity of these solutions:

a) 4.67 moles of Li2SO3 dissolved to make 2.04 liters of solution.  
b) 0.629 moles of Al2O3 to make 1.500 liters of solution.  
c) 4.783 grams of Na2CO3 to make 10.00 liters of solution.  
d) 0.897 grams of (NH4)2CO3 to make 250 mL of solution.  
e) 0.0348 grams of PbCl2 to form 45.0 mL of solution.

17. Determine the number of moles of solute to prepare these solutions:

a) 2.35 liters of a 2.00 M Cu(NO3)2 solution.  
b) 16.00 mL of a 0.415-molar Pb(NO3)2 solution.  
c) 3.00 L of a 0.500 M MgCO3 solution.  
d) 6.20 L of a 3.76-molar Na2O solution.

18. Determine the grams of solute to prepare these solutions:

a) 0.289 liters of a 0.00300 M Cu(NO3)2 solution.  
b) 16.00 milliliters of a 5.90-molar Pb(NO3)2 solution.  
c) 508 mL of a 2.75-molar NaF solution.  
d) 6.20 L of a 3.76-molar Na2O solution.  
e) 0.500 L of a 1.00 M KCl solution.  
f) 4.35 L of a 3.50 M CaCl2 solution.

19. Determine the final volume of these solutions:

a) 4.67 moles of Li2SO3 dissolved to make a 3.89 M solution.  
b) 4.907 moles of Al2O3 to make a 0.500 M solution.  
c) 0.783 grams of Na2CO3 to make a 0.348 M solution.  
d) 8.97 grams of (NH4)2CO3 to make a 0.250-molar solution.  
e) 48.00 grams of PbCl2 to form a 5.0-molar solution.

**6-5 Lab**

**Supersaturation**

Objective:

1. Prepare a supersaturated solution of sodium acetate.
2. Observe the effect of seeding a supersaturated solution.

Materials:

Sodium Acetate Distilled Water

Ice

Procedure:

1. Place 5g of sodium acetate in a clean test tube. Add 10 mL of distilled water.
2. Hold the test tube in a test tube holder and heat it in a burner flame, agitating the mixture gently until all of the solid has dissolved. Place the test tube in a test tube rack. Add one more crystal of sodium phosphate to the warmed solution and record your observations.
3. After 5 minutes, place the test tube in a beaker of ice water to cool. Be careful not to disturb the test tube or its contents during the cooling process. If crystals begin to form in the solution, as it is cooling, reheat the tube to redissolve the crystals, and cool the tube again.
4. When the solution is cold, gently remove the tube from the ice water bath. Replace the test tube in the rack and drop in one small crystal of sodium phosphate. Describe what you see. Touch the bottom of the test tube to the palm of your hand. Record your observations.
5. Dispose of the crystals by washing them into the sink and flushing them down the drain with water.

Results and conclusions:

1. At the end of step 2, is the solution unsaturated, saturated, or supersatured? Explain.
2. At the end of step 3, is the solution unsaturated, saturated, or supersatured? Give evidence for your answer.
3. At the end of step 4, when crystallization is complete, is the solution unsaturated, saturated, or supersaturated? Explain.
4. Describe one simple test that will determine whether a solution is unsaturated, saturated, or supersaturated. Explain how to interpret the test.

**6-6 Activity Series Lab**

# Background Information

One way to arrange the elements in the periodic table is by order of their activity. A metal is said to more active than another metal if it will replace the less active metal from a solution of one of its compounds. This can be observed because the metal with the lower activity is “plated out” as pure metal on the piece of metal with the higher activity. By performing a series of experiments, you can develop a list of metals in order of their activity.

In this investigation, you will test zinc, copper, and tin to see if they will replace each other in solutions of their compounds.

# Problem

How can you determine the relative activities of zinc, copper, and tin?

# Materials

Solutions: copper II sulfate, zinc sulfate, and lead acetate

Small strips: zinc, lead, copper

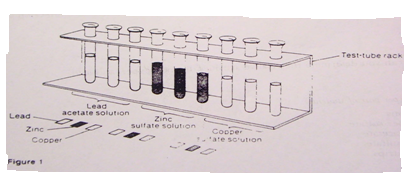
Sandpaper

9 small test tubes

Test tube rack

# Procedure

1. Put on safety goggles.
2. Arrange the nine test tubes in three groups of three each. Using a marker, label the first three test tubes “lead acetate,” the next three “zinc sulfate,” and the last three “copper sulfate.” See Figure 1



3. Fill the appropriately labeled three tubes one-third full of lead acetate solution. Fill the appropriately labeled three tubes one-third full of zinc sulfate solution. Fill the appropriately labeled remaining three tubes one-third full of copper II sulfate solution.

4. Clean the metal strips by rubbing with sandpaper. Using a separate tube for each strip of metal, place strips of lead, zinc, and copper in each of the three kinds of solutions.

5. After several minutes, examine the strips for evidence of a reaction: remove them from the solutions if necessary. Record your observations in the Data Table. Also note if the solution changed color.

# Observations

|  |  |  |  |
| --- | --- | --- | --- |
|  | Lead Acetate | Zinc Sulfate | Copper II Sulfate |
| Lead |  |  |  |
| Zinc |  |  |  |
| Copper |  |  |  |

1. Which metal did not react with any of the solutions it was placed in? \_\_\_\_\_\_\_\_\_\_\_\_

Conclusion:

1. List the metals in order of decreasing activity. 1. 2. 3.

2. How could you tell which of the three metals was the most active?

3. Magnesium is more active than zinc. How would a strip of magnesium have reacted in the three solutions you studied?

4. A strip of silver does not react with any of the solutions tested. What must be true about silver?

**6-7 Activity Series & Oxidation Worksheet**

Predict the products of the following single replacement reactions at room temperature (~ 20-25o C):

* whoever top dog is on the chart will get the date
  + replace the other if a new top dog comes in.
* Look up the charges, criss cross, then balance the equation.
* Decide which product compounds are oxidized and which are reduced.
* BTW – Charges are also referred to as oxidation numbers. For example, Oxygen’s oxidation number is -2.

1. K + Ag2S 🡪

2. Br2 + NaCl 🡪

3. Pb (IV) + NiCl2 🡪

4. Al + SnO 🡪

5. F2 + KI 🡪

6. Au (II) + PtBr2 🡪

7. Mg + Cu(NO3)2  🡪

8. Na + KF 🡪

9. Cl2 + CaF2 🡪

10. Li + KBr 🡪

**6-8 Review**

1. What is a solution?
2. Classify each of the following as a heterogeneous mixture or a homogeneous mixture.
   1. salad \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. tap water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. muddy water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What is the difference between a solute and solvent?
4. What is considered to be the “universal solvent?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. EXPLAIN the 3 factors that affect the rate of dissolving?
6. Define solubility
7. What are 3 factors that affect solubility? How do they affect gasses? How do they affect solids?
   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Explain the rule, “Like Dissolves Like”.
9. State whether each of the following will conduct an electric current. Also, explain why each does or does not conduct an electric current.
   1. salt (NaCl) water
   2. sugar water (covalent compound in water)
10. What are the differences between a saturated solution, unsaturated solution and a supersaturated solution?
11. How could you tell by looking at a solution that it was saturated?

*Use the solubility curve below to answer the following questions*:

1. Which salt is LEAST soluble at 20 °C? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. How many grams of KBr can be dissolved in 100g of water at 60°C? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. How many grams of NaCl can be dissolved in 100g of water at 100°C? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. At 40°C, 180g of NaClO3 is dissolved in 100g of water. Is this solution saturated or unsaturated?

\_\_\_\_\_\_\_\_\_\_\_\_\_

1. At 70°C, 70g of KBr is dissolved in 100g of water. Is this solution saturated or unsaturated?

\_\_\_\_\_\_\_\_\_\_\_\_\_

1. A saturated solution of NaClO3 is

formed from one hundred grams of

water. If the saturated solution is

cooled from 80°C to 60°C, how many

grams of precipitate are

formed?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. How much of the solute will dissolve

and how much will remain

undissolved at the bottom of the test

tube?

* 1. 160 g of KNO3 in 100 g of water at 50ºC

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

19) What is the molarity of 6 moles of NaCl in 2 liters of water?

20) How many moles of NaCl do you need for a 2 M solution if you have 5 liters of water?

21) How many liters of water do you need to make a 5.2 M solution if you have 4 moles of NaCl?

22) how many grams would you need to make a 2 M solution of NaCl with 3 liters of water?

23) Is evaporation a chemical change?

24) What is a product, a reactant, and a coefficient?

25) the purpose of balancing an equation is so that the mass of the products equals the reactants. This satisfies the law of conservation of \_\_\_\_\_\_\_\_\_\_\_\_\_?

26) List all the types of reactions. In your own words, explain how you can identify each.

27) Reactions that give off heat are \_\_\_\_\_\_\_\_\_\_\_\_\_\_. Reactions that absorb heat and make their surroundings cold are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

28) Precipitation happens when a \_\_\_\_\_\_\_\_\_\_\_ is formed in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_replacement reaction.

29) What are the oxidation numbers of Na and Cl?

30) In the compound NaCl, which is oxidized? Which is reduced?

31) Which is soluble, ionic or covalent compounds?

**6-9 Ice Cream Lab**

Who knew chemistry could be so tasty! Today we will be investigating how additives affect solutions, specifically by how they affect freezing points, and some yummy results of energy changes.  
  
Pre-Lab reading  
Ice cream, a mixture of milk, sugar and vanilla, is really an aqueous mixture (which means dissolved in water) with many particles in each liter. When you add particles to water it makes it harder to freeze, so the temperature must be lower than pure water. Because of this, the freezing point of ice cream is lower than that of water. So to freeze ice cream, or to keep it frozen, you must keep its temperature significantly below 0 degrees Celsius. Adding salt to ice produces a melting ice and saltwater mixture with a depressed (lowered) freezing point in which the ice cream can be frozen.  
  
**PRE-LAB QUESTIONS**  
  
1)Is the freezing point of ice cream lower or higher than the freezing point of water?  
2)To freeze ice cream, what temperature must it be lower than?  
3)What does adding salt to ice do?  
4)Is this an endothermic reaction(requires energy so it gets colder) or exothermic reaction (Gives off energy so it gets hotter)?  
5)Out of (ice, milk, salt, vanilla, sugar) Which of the 5 ingredients do you want IN the ice cream?  
6)Which of the 5 ingredients should NOT be in the ice cream?  
7)You have two baggies. One big, one small. Why do you need 2 baggies for this experiment?  
  
**Instructions**  
PLEASE MEASURE AND POUR OVER THE SINK. CLEAN UP YOUR MESSES.  
In Small Bag

* 1/2 cup milk
* 1/4 teaspoon vanilla (Or other flavor)
* 1 tablespoon sugar

In Large Bag

* 1/2 full of ice
* 2 tablespoons salt
* Put the small bag zipped up

Put closed small bag in big bag (Do not mix the contents)  
Shake the bag for nearly 5 minutes or till it feels firm over a sink  
  
**Analysis**:  
8)What state of matter was the milk when you began?  
9)What state of matter was the milk when you were done?  
10)If you did not add sugar, would the ice cream freeze faster or slower? Why? Explain, using your knowledge of chemistry. (read the beginning paragraph)  
11)Why did the outside of the bag get wet? (assume that your bag did not spring a leak.)  
12)Where did the water on the outside of your bag come from?